

**REMARKS**

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons which follow.

Claim Rejections – 35 U.S.C. § 112

In section 4 of the Office Action, the Examiner rejected claims 1-10, 11-22, 31-35 and 36-46 under 35 U.S.C. § 112, first paragraph, as based on a disclosure which is not enabling. The Examiner stated:

The interference effect, between the optical input signals, is critical or essential to the practice of the invention, but not included in the claim(s) (1, 11, 31, 36) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). The specification fails to teach adequately as how could a Boolean logic output be provided by simply having a plurality of optical pathways in the optical layer and simply based on the optical output.

The specification also fails to disclose what does it mean by "optical bias" and fails to teach adequately as how to produce such "optical bias".

The specification also fails to disclose how could "at least two (or three) optical conduits configured to receive an optical input", as recited in claims 12 and 14. The specification only gives the support for one optical conduit to receive on optical input.

Claims 2-10, 12-22, 32-35, and 37-46 inherit the rejections from their respective based claim.

Independent claims 1, 11, and 37 have been amended to recite "an interference region" which the Examiner believes is "critical or essential to the practice of the invention." Independent claim 31 has similarly been amended to recite "at least a portion of the plurality of optical pathways configured to selectively cause interference between wavefronts of the first selective optical input signal and the second optical input signal," thus providing the interference effect between the optical input signals which the Examiner believes is "critical or essential to the practice of the invention."

The Examiner has also objected to the specification failing to disclose what is meant by "optical bias", to which Applicant disagrees. Applicant directs the

Examiner's attention, for example, to page 4, lines 15-19 and page 4, line 25 - page 5, line 2, in which the bias input is described as a constant light input (as further disclosed in Tables I-III). Accordingly, applicants respectively submit that the specification adequately discloses what is meant by an optical bias and further applicants submit that how to produce such an optical bias is well known to those skilled in the art, as producing an optical bias or a constant light input is akin to nothing more than leaving a light on.

The Examiner states that "[t]he specification also fails to disclose how could 'at least two (or three) optical conduits configured to receive an optical input,' as recited in claims 12 and 14." Applicant respectfully submits that optical conduits, for example, 305, 310, and 315 of FIG. 3 are configured to receive three optical inputs, the three conduits being coupled to interference region 325. Further, other examples of at least two optical conduits are disclosed in FIGs. 1, 2, 4, and 5 and the accompanying description. Accordingly, claim 14, as amended, as well as claim 11, which includes some of the limitation of cancelled claim 12, recite subject matter that is supported by the specification.

In section 6 of the Office Action, the Examiner rejected claims 1-10, 11-22, 31-35, and 36-46 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner stated:

The phrases "optical input", "optical bias", "bias input" and the "optical output" recited in various claims appear to be vague and indefinite since it is not clear if they are referred to physical structures for relaying various light signals to the logical gate or they are referred to the actual light signals that propagate through the optical logical gate.

Claims 1, 11, 31 and 36 are rejected under 35 U.S.C. § 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: the interference region or effect.

Claim 2-6, 12-13, 14-16, 32, and 37-41 are rejected under 35 U.S.C. § 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the

necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: among the optical pathways or optical conduits and the interference region and among the "optical input", the "first selective input", "an optical bias", "a bias input", "an interference region output", and "second selective input" recited in various claims. These lacking of the structural and logical relationships make the scopes of the claims unclear.

The phrase "the interference region includes a first selective input, a bias input and an interference region output" recited in claims 3 and 38 appears to be vague and indefinite since the interference region may be coupled to the input, output and bias input but it certainly does not include them.

The phrase "is representative of the NOT (or NOT AND (NAND)) function" appears to be confusing since it is not clear what does this "representative" mean. If the logic output function is a NOT or NAND function then specifically states so.

The phrase "having a plurality of optical logic gates configured to function as an optical process" recited in claims 9 and 44 appears to be vague and indefinite since it is not clear what are these "optical logical gates" referred here. It is also not clear how does these optical logical gates relate to the elements recited in its base claims (1 and 36). The phrase "is comprises" recited in claims 10 and 45 appears to be vague and indefinite. The scopes of the claims re therefore not clear.

The phrase "at least two of the optical inputs" recited in claim 16 appears to be vague and indefinite since it lacks proper antecedent basis from its based claim.

The phrase "providing a light" recited in claim 31 appears to be vague and indefinite since it is not clear how does this phrase relate to the phrase "providing light to the at least one optical input" recited in earlier part of the claim.

Claim 41 appears to be confusing, in error and indefinite in particular it is not clear what does the phrase "and light is provided to neither of the first and second selective inputs" mean. The scope of the claim therefore is unclear.

Claims as stand now contain numerous errors, confusions, inconsistent terms and phrases, and indefiniteness. The

examiner can only point out a few. It is the applicant's responsibilities to clarify ALL of the discrepancies in the claims to make them in comply with the requirements of 35 U.S.C. § 112. The dependent claims inherit the rejections from their various based claims.

Applicants respectfully submit that claims 1, 4-11, 13-22, 31-36, and 38-46 have been amended in part to overcome the Examiner's rejections under 35 U.S.C. § 112, second paragraph. Accordingly, applicants believe that the claims as amended overcome the Examiner's section 112, second paragraph objections.

Claim Rejections – 35 U.S.C. § 102

In Section 8 of the Office Action, the Examiner rejected claims 11, 16, 36-37, 43 and 46 under 35 U.S.C. § 102(b) as being anticipated by the patent issued to Utaka et al. (USPN 5,315,422). The Examiner stated:

Utaka et al. teaches an interference type optical logic element for controlling optical signal by light, i.e. an optical processor, that is comprised of:

- (1) a substrate (3) of a first semiconductor material, and
- (2) a patterned optical layer (7) overlaying the substrate of a second semiconductor material.

Utaka et al. teaches that the optical layer (7) is patterned with a plurality of optical waveguides serve as the optical conduits (I and II) with at least one of the optical conduits receives an optical input light signal (Pi) and at least one of the optical conduits configured to provide an optical output light signal (Po), (please see Figures 2A, 2B, 3-5, 6A and 7-10). The input light signal propagates through the plurality of the waveguides or conduits to reach a region such that the light signals from the various waveguides interfere to each other wherein the interference causes the output light signal to perform a Boolean logic function, (please see columns 4-5).

With regard to claims 43 and 46, Utaka et al. teaches that the optical logic element may perform logic functions such as NAND and XOR, (please see column 8).

This reference has therefore anticipated the claims.

Independent claim 11 recites "at least one of the at least two optical input signals being an optical bias signal." Utaka et al. does not teach, disclose or suggest utilizing an optical bias signal. Applicant refers the Examiner to Tables I – IV of Utaka et al. which illustrate that inputs  $P_i$  are not constant inputs (i.e., they are not optical bias inputs). Accordingly, Utaka et al. does not anticipate independent claim 11 and its dependent claim 16.

How so  
With regard to independent claim 36, independent claim 36 recites "an interference region configured to selectively cause interference of wavefronts of light from the optical input signals entering the interference region." Utaka et al. teaches a single input signal  $P_i$  (see FIG. 2A), the signal  $P_i$  is modulated along two different optical conduits I and II by light controls  $P_1$  and  $P_2$ , respectively. Utaka et al. therefore does not teach an interference region that selectively causes interference of wavefronts of light from optical input signals entering the interference region. Utaka et al. teaches the interference of a single input signal that is modulated by multiple control sources. Accordingly, Utaka et al. does not anticipate independent claim 36 and its dependent claims 37, 43, and 46.

In section 9 of the office action, the Examiner rejected claims 31-33 under 35 U.S.C. § 102(b) as being anticipated by the patent issued to Yang (USPN 5,239,173). The Examiner stated:

Yang teaches a binary data processor for providing various logical functions wherein the processor comprises a coherent light source (11) for providing light through light pipes (41) serve as the plurality optical pathways and slits (13 and 14) serves as the optical inputs to a portion such that the light from the plurality of pathways or light pipes interfere with each other, (please see Figures 4 and 5, column 4). The interference pattern is transmitted via output light pipes (42) or fiber optic bundle (43) as the optical output light signal that may represent various logic functions such as AND, OR and NOT. This reference has therefore anticipated the claims.

With regard to independent claim 31, independent claim 31 recites "providing a plurality of optical pathways formed of optical transmission material patterned on a substrate material. Yang teaches "an optical processor 10, wherein a coherent light source 11 projects a beam of light which illuminates a pair of slits 13 and 14 in the

87c ( wall 18 of a sealed chamber 17." Yang, column 2, lines 60-64. Further, Yang teaches "the invention comprises a sealed chamber having a pair of opposing walls. Two or more slits are disposed in a front wall, and the slits are spaced along the front wall such that coherent light falling on the slits produces an equal number of diffracting beams of light. A source of coherent light is provided externally of the sealed chamber, and light therefrom is transmitted to the slits by traveling along a path in a medium which may be air, vacuum, or a bundle of fiber optic tubes." Yang, Col. 2, lines 8-16. Accordingly, Yang does not teach or disclose the optical pathways formed of optical transmission material patterned on a substrate material. Further, Yang does not teach or disclose that "at least a portion of the plurality of optical pathways to be configured to selectively cause interference between wavefronts of the first selective optical input signal and the second optical input signal." The interference of Yang is caused within a sealed chamber that is not formed of an optical transmission material patterned on a substrate material. Rather, the sealed chamber of Yang is empty space or may include air or other gas. Accordingly, Yang does not teach or disclose all of the elements recited in independent claim 31 and its dependent claims 32 and 33. Accordingly, claims 31-33 are not anticipated by Yang.

#### Claim Rejections – 35 U.S.C. § 103

In section 11 of the Office Action, the Examiner rejected claims 12-15 and 17-22 under 35 U.S.C. § 103(a) as being unpatentable over the patent issued to Utaka et al. The Examiner stated:

The interference type optical logic element taught by Utaka et al. as described for claim 11 above has met all the limitations of the claims.

With regard to claims 12-15, Utaka et al. teaches that the patterned optical layer may have two or three wavelengths or conduits for receiving optical input light signal to perform various logical operations such as AND, NAND, OR, XOR, NXOR. However this reference does not teach explicitly that the input light signals are biased and the logic function is NOT. But since the specification of the instant application fails to teach what is considered here to be an "optical bias" such feature therefore cannot be addressed. Although this reference does not teach explicitly to have the NOT logic function however since this is one of the most standard logic functions in the art.

Incidentally, both NAND and NXOR functions include NOT function. And since this reference teaches explicitly to induce phase difference among the optical input light signals to create the various logic functions to modify the logic element to perform the NOT logic function would have been obvious to one skilled in the art since it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

With regard to claims 17-20, Utaka et al. teaches that the optical layer or the substrate may be formed by doped Gallium Arsenide, (please see column 1). However it does not teach explicitly that it may also be formed by doped silicon. However doped silicon is a very well known semiconductor material for making logic circuit in the art and since the specification fails to teach the criticality of having this particular materials would overcome any problem in the prior art such modification would have been obvious matter design choice to one skilled in the art.

With regard to claims 21 and 22, Utaka et al. teaches that a semiconductor DFB laser may be used as the light source to provide the input light signals, (please see Figure 8A and column 8).

With regard to dependent claims 12-15, Applicant submits that dependent claim 12 has been cancelled without prejudice. Dependent claims 13-15 all depend from independent claim 11. As explained in detail above, Applicant believes that independent claim 11 is allowable. Accordingly, Applicant believes that dependent claims 13-15 which depend from independent claim 11 are allowable.

With regard to dependent claims 12-15 and 17-22, Applicant submits that dependent claim 12 has been cancelled without prejudice. Dependent claims 13-15 and 17 -22 all depend from independent claim 11. As explained in detail above, Applicant believes that independent claim 11 is allowable. Accordingly, Applicant believes that dependent claims 13-15 and 17-22 which depend from independent claim 11 are also allowable.

In section 12 of the Office Action, the Examiner rejected claims 34 and 35 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over the patent issued to Yang. The Examiner stated:

The optical binary data processor that performs logical functions taught by Yang as described for claim 31 above has met all the limitations of the claims. Yang further teaches that logic circuit system having multiple logic steps can be constructed from combination of basic logic functions AND, OR and NOT. In Figure 6, Yang teaches a data processor system having a cascaded series of N \_\_\_\_\_ optical processing steps that may include various combinations of the basic logic functions. Although this \_\_\_\_\_ reference does not teach explicitly to have NOT AND (NAND) function and to have NOT and NOT AND function however since these functions are combinations of the basic logic functions they are therefore either implicitly included or obvious modifications to one skilled in the art.

With regard to claims 34 and 35, Applicant respectfully submits that claims 34 and 35 depend from independent claim 31. As explained above, Applicant believes that independent claim 31 is allowable. Accordingly, Applicant respectfully submits that claims 34 and 35 which depend from independent claim 31 are also allowable.

In section 13 of the Office Action, the Examiner rejected claims 1-10, 38-42, and 44-45 under 35 U.S.C. § 103(a) as being unpatentable over the patent issued to Utaka et al. The Examiner stated:

Utaka et al. teaches an interference type optical logic element for controlling optical signal by light, i.e. an optical processor, that is comprised of:

- (1) a substrate (3) of a first semiconductor material, and
- (2) a patterned optical layer (7) overlaying the substrate of a second semiconductor material.

Utaka et al. teaches that the optical layer (7) is patterned with a plurality of optical waveguides serve as the optical pathways (I and II) with at least one of the optical pathways receives an optical input light signal ( $P_i$ ) and at least one of the optical pathways configured to provide an optical output light signal ( $P_o$ ), (please see Figures 2A, 2B, 3-5, 6A and 7-10). The input light signal propagates through the plurality of the waveguides or pathways to reach a region such that the light signals from the various waveguides interfere to each other wherein the interference causes the output light signal to perform a Boolean logical function, (please see columns 4-5).



This reference has met all the limitation of the claims with the exception that it does not teach explicitly that at least one of the optical pathway transmits a biased optical signal. However since the specification of the instant application fails to teach what is considered to be an "optical bias" such feature therefore cannot be addressed here.

With regard to claims 3-8 and 38-42 Utaka et al. teaches that the patterned optical layer may have two or three waveguides or pathways for receiving optical input light signal to perform various logical operations including AND, NAND, OR XOR, NXOR. Although this reference does not teach explicitly to have the NOT logic function however since this is one of the most standard logic functions in the art. Incidentally, both NAND and NXOR functions include NOT function. And since this reference teaches explicitly to induce phase difference among the optical input light signals to create the various logic functions to modify the logic element to perform the NOT logic function would therefore have been obvious to one skilled in the art since it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

With regard to claims 9-10 and 44-45, Utaka et al. teaches that the optical logic element is used as optical processor for processing and controlling optical signals. Utaka et al. also teaches that a plurality of optical logic elements may be integrated such that a combination of basic logic functions (AND, OR and NOT) can be achieved to provide more complicated logic function such as NAND, XOR and NXOR. Although this reference does not teach explicitly to have the combined NOT and NAND functions such modification would have been obvious to one skilled in the art since it simply involves combining these elements for the purpose of performing the desired logic function.

With regard to independent claim 1, the Examiner has stated that Utaka et al. does not teach, disclose, or suggest the use of an "optical bias signal." The Examiner claims that the specification fails to teach what is considered to be an "optical bias." However, as explained in detail above with regard to the Examiner's section 112 rejections, Applicant respectfully submits that the specification adequately discloses what is considered to be an optical bias signal, that is, a constant light input. An optical bias in the claimed optical logic circuit configuration is not taught by the prior

art. Accordingly, Applicant respectfully submits that independent claim 1 and its dependent claims 4-10 are allowable.

With regard to dependent claims 38-42 and 44-45, Applicant respectfully submits that dependent claims 38-42 and 44-45 depend from independent claim 36, which Applicant believes is allowable as amended. Accordingly, Applicant respectfully submits that dependent claims 38-42 and 44-45 which depend from independent claim 36 are also allowable.

Double Patenting

In section 15 of the Office Action, the Examiner stated:

Applicant is advised that should claims 11 and 16 be found allowable, claims 36-37 will be objected to under 37 C.F.R. § 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

The Examiner should note that claims 16 and 37 have been cancelled without prejudice. Claims 11 and 36 have been amended in such a manner that they are not duplicates, thus the double patenting rejection under 35 U.S.C. § 101 no longer applies.

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After amending the claims as set forth above, claims 1, 4-11, 13-15, 17-22, 31, 33-36, and 38-46 are now pending in this application.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Respectfully submitted,

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